Delicious Dinner or Ruined Ration?

Completed Technology Project (2012 - 2012)

Project Introduction

A question for long-duration human presence and performance in space is: has the food shelf-life expired? Food for long-duration manned missions will require shelf-life over 900 days in lightweight, non-toxic, and impervious materials. The innovative idea is to use packaging that can preserve food longer, by adding a graphene layer to traditional food grade thin film. An ultra-thin graphene layer on polyethylene film is a new approach to produce semi-transparent food packaging that reduces oxygen and water vapor transmission rates. Research suggests that carbon nanotechnology can benefit food packaging, but till now, little has been done with graphene. Research at NASA/JSC already indicates that coating thin polymer films with carbon allotropes lowers their gas permeability. This proposal encompasses the feasibility study of graphene/polyethylene films for use in lightweight and safe food packaging.

The idea is to develop a graphene/polyethylene layer that can be laminated to other thin films as is commonly done in the food packaging industry. A typical food packaging film has more than five layers of materials that confer altogether the desired physical and mechanical properties of the package. The proposal encompasses the feasibility study of graphene/polyethylene films for use in lightweight and safe food packaging. The focus of this project is the construction, characterization, and demonstration of a flexible, impermeable membrane for use in any application where gases are required to be contained or excluded, such as food and drug packaging, or inflatable modules and habitats. Graphene is essentially single-layer graphite, and can be thought of as an unrolled nanotube. Graphene has shown promise to be impermeable to all gases. It has been observed that as little as a single atomic layer of graphene is impenetrable by gases, including helium [J. S. Bunch et al., Nano Lett., 8, 2458 (2008)]. This property can be exploited to fabricate impermeable membranes. Graphene will be embedded within polymer films for fabrication of these impermeable membranes.

Anticipated Benefits

Enabling long duration manned missions when resupply capabilities are limited and infrequent.

There is no currently acceptable lightweight, non-toxic semi-transparent film packaging material that guarantees a shelf-life for food over 18 months.

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Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Center Innovation Fund: JSC CIF

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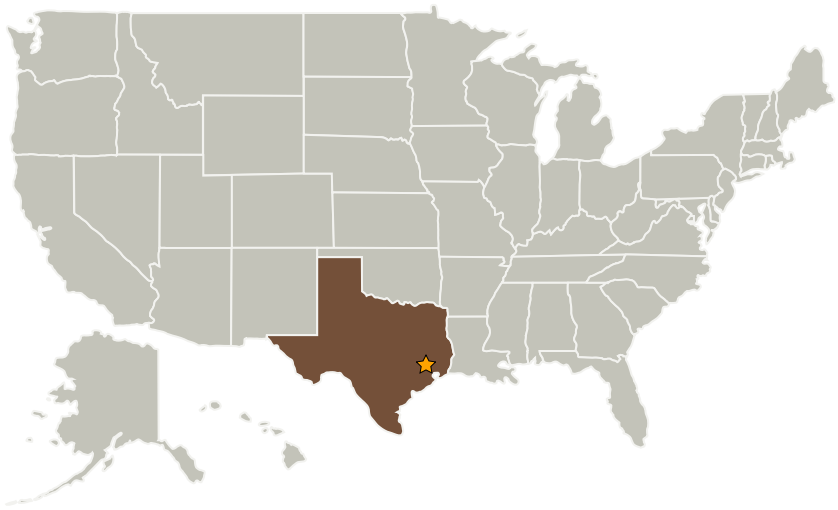
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Jacobs Engineering Group, Inc.	Supporting Organization	Industry	Dallas, Texas

Primary U.S. Work Locations
Texas

Project Management

Program Director:
Michael R Lapointe

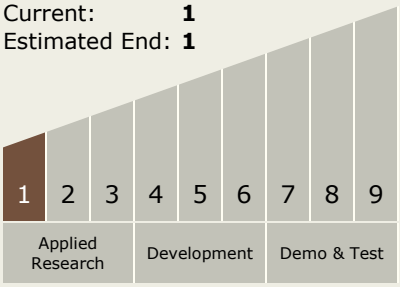
Program Manager:
Carlos H Westhelle

Project Manager:
Evelyne S Orndoff

Principal Investigator:
Evelyne S Orndoff

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **1**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.4 Advanced Propulsion
    - TX01.4.1 Solar Sails